

In the Claims

The following listing replaces all previous versions of the Claims.

We claim:

1. (canceled)
2. (canceled)
3. (currently amended) In a human-computer interface, a method of allowing a user of a haptic input device to affect the motion of an object in a computer application, comprising:
 - a) Establishing an object fundamental path representing a path of motion of the object in the computer application;
 - b) Establishing a device fundamental path in correspondence with the object fundamental path;
 - c) Detecting motion of the haptic input device;
 - d) Moving the object in the computer application along the object fundamental path responsive to a component of haptic input device motion along the device fundamental path; and
 - e) While the user moves the haptic input device along the device fundamental path, aApplying a first force to the haptic input device responsive to a component of haptic input device motion not along the device fundamental path; and simultaneously
 - f) ~~—~~ aApplying a second force to the haptic input device responsive to interaction of the object with the application.
4. (previously presented) A method as in Claim 3, further comprising applying forces to the haptic input device corresponding to motion of the object in the application, wherein the forces provide a perception of momentum and inertia of the haptic input device corresponding to momentum and inertia of the object in the application.
5. (previously presented) A method as in Claim 3, wherein the application comprises a plurality of states, and wherein the shape of the object fundamental path is dependent on the state of the application.
6. (previously presented) A method as in Claim 3, wherein the application comprises a plurality of states, and wherein the shape of the device fundamental path is dependent on the state of the application.
7. (previously presented) A method as in Claim 3, wherein the object interacts with the application, and wherein the interaction of the object with the application is dependent on the speed of the object along the object fundamental path.

8. (previously presented) A method as in Claim 3, further displaying a visual representation of the object to the user.
9. (previously presented) A method as in Claim 8, wherein the visual representation when the haptic input device is on the device fundamental path is perceptively different from the visual representation when the haptic input device is not on the device fundamental path.
10. (previously presented) A method as in Claim 3, further comprising:
- a) Establishing a second object fundamental path representing a path of motion of a second object in the computer application;
 - b) Establishing a second device fundamental path in correspondence with the second object fundamental path;
 - c) Detecting motion of the haptic input device;
 - d) Determining if either device fundamental path is active, and if so, then
 - e) Moving the first object if the first device fundamental path is active, or the second object if the second device fundamental path is active, in the computer application along the active object fundamental path responsive to a component of haptic input device motion along the active device fundamental path; and
 - f) Applying a force to the haptic input device responsive to a component of input device motion not along the active device fundamental path.
11. (previously presented) A method as in Claim 3, wherein the object comprises two representations, a visual representation that is used in a display to provide visual feedback to the user, and an interaction representation that is used with the haptic input device to provide force feedback to the user.
12. (currently amended) A method as in Claim 3, wherein the first force has a first magnitude for a first position of the haptic input device a first distance from the device fundamental path, and a second, larger magnitude for a second position of the haptic input device a second, larger distance from the device fundamental path.
13. (currently amended) A method as in Claim 3, further comprising applying a third force along the device fundamental path opposing motion of the haptic input device beyond an end of the device fundamental path.
14. (currently amended) In a human-computer interface, a method of allowing a user of a haptic input device to affect the motion of an object in a computer application, comprising:

- a) Establishing an object fundamental path representing a path of motion of the object in the computer application;
- b) Establishing a device fundamental path in correspondence with the object fundamental path;
- c) Detecting motion of the haptic input device;
- d) Moving the object in the computer application along the object fundamental path responsive to a component of haptic input device motion along the device fundamental path; and
- e) Applying a first force to the haptic input device responsive to a component of haptic input device motion not along the device fundamental path; and
- f) Applying a second force to the haptic input device to urge the haptic input device to a starting region of the range of motion of the haptic input device, where the starting region comprises a region of the range of motion of the haptic input device such that, when the object is moved along the full object fundamental path in correspondence with motion of the haptic input device along the device fundamental path, ~~starting in the starting region will not require~~ motion of the haptic input device outside its range of motion will not be required.

- 15. (previously presented) A method as in Claim 3, wherein the device fundamental path has a different shape than the object fundamental path.
- 16. (previously presented) A method as in Claim 15, wherein the device fundamental path defines a curve in three-dimensions.
- 17. (previously presented) A method as in Claim 16, wherein the device fundamental path defines a curve in two-dimensions.
- 18. (previously presented) A method as in Claim 15, wherein the device fundamental path defines a surface in three-dimensions.
- 19. (previously presented) A method as in Claim 3, wherein a characteristic of the object in the application is responsive to motion of the haptic input device off the device fundamental path.
- 20. (currently amended) A method as in Claim 19, wherein the first force resists motion of the haptic input device off the device fundamental path along a first dimension, and wherein a characteristic of the object in the application is responsive to motion of the haptic input device off the device fundamental path along a second dimension different from the first dimension.
- 21. (currently amended) A method as in Claim 3, wherein the second force is at least partly along the device fundamental path, and wherein the magnitude of the second force is partially dependent on the position of the object along the object fundamental path.

22. (currently amended) A method as in Claim 3, wherein the second force is at least partly along the device fundamental path, and wherein the magnitude of the second force is partially dependent on interaction of the object with the application.

23. (currently amended) A method as in Claim 3, wherein the magnitude of the first force is partially dependent on a user-assistance parameter of the interface such that the first force has a first non-zero magnitude corresponding to a first value of the user assistance parameter, and a second non-zero magnitude, different from the first non-zero magnitude, corresponding to a second value of the user assistance parameter.

24. (original) A method as in Claim 23, wherein the user-assistance parameter is established by a measure of the user's proficiency in manipulating the input device.

25. (previously presented) A method as in Claim 14, additionally comprising:

- a) Defining a motion-initiation region comprising a portion of the haptic input device range of motion;
- b) Determining when the haptic input device is within the motion-initiation region; and
- c) When the haptic input device is within the motion-initiation region, applying a force to the haptic input device urging the haptic input device to the device fundamental path.

26. (currently amended) A method as in Claim 3, wherein establishing a device fundamental path comprises:

- a) Determining when the user supplies a motion-initiation signal, which motion-initiation signal comprises an input from the user other than positioning of the object in a defined region; and then
- b) Establishing a device fundamental path according to a defined device path and the position of a cursor controlled by the user when the motion-initiation signal was supplied.

27. (original) A method as in Claim 26, wherein the motion-initiation signal comprises motion of the cursor to a defined range of the cursor's range of motion.

28. (currently amended) A method as in Claim 26, wherein the motion-initiation signal comprises a hardware switch actuated by the user.

29. (currently amended) A method as in Claim ~~28~~7, wherein the motion-initiation signal further comprises detection of the position of the cursor in a defined range of the cursor's range of motion when the switch is actuated.

30. (previously presented) A method as in Claim 26, wherein the motion-initiation signal comprises motion of the haptic input device having defined characteristics.

31. (previously presented) A method as in Claim 3, wherein:

- a) The computer application comprises a golf simulation;
- b) The object comprises a golf club; and
- c) The object fundamental path comprises a path suited for perception of the swing of a golf club; and
- d) Applying a force to the haptic input device responsive to interaction of the object with the application comprises applying a force to the haptic input device responsive to interaction of the object with other objects in the application.

32. (previously presented) A method as in Claim 3, wherein:

- a) The computer application comprises a pool simulation;
- b) The object comprises a pool cue; and
- c) The object fundamental path comprises a path suited for perception of the motion of a pool cue.

33. (canceled)

34. (previously presented) A method as in Claim 15, wherein the correspondence between the device fundamental path and the object fundamental path is not one to one.

35. (currently amended) In a computer presentation of the interaction of three or more objects simulating physical objects and simulating interactions among at least three of the three or more objects, a method of allowing a user to use a haptic interface device to control the motion of a defined object of such objects, comprising:

- a) Establishing an object fundamental path representing a path of motion of the defined object in the computer application;
- b) Establishing a device fundamental path in correspondence with the object fundamental path representing a path that can be followed by the haptic interface device;
- c) Detecting motion of the haptic interface device;
- d) Moving the object in the computer application along the object fundamental path responsive to a component of haptic interface device motion along the device fundamental path; and
- e) Applying a force to the haptic interface device responsive to a component of input device motion not along the device fundamental path.

36. (previously presented) A method as in Claim 35, further comprising applying a force to the haptic interface device responsive to interaction of the object with another object in the computer presentation.

37. (previously presented) A method as in Claim 35, further comprising:

- f) accepting a signal from the user indicating that a path interaction is desired, and, when said signal is accepted, then moving the object according to d) and e);

g) accepting a signal from the user indicating that a path interaction is not desired, and, when said signal is accepted, then moving a cursor in the computer presentation corresponding to motion of the haptic interface device.

38. (previously presented) A method as in Claim 31, wherein the object fundamental path and the device fundamental path have different shapes.